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FRAGMENTING MEANING: CLARIFICATION ELLIPSIS
AND NOMINAL ANAPHORA

1. INTRODUCTION

One of the most commonplace contextual effects of an utterance is the potential for phrasal clarification ellipses (CE), exemplified in (1a), in which an attempt is made to clarify one or more *constituents* of the previous utterance. An utterance such as B's in (1b2) has at least two types of readings: one reading (the **clausal** reading) is paraphraseable as (1c), where the capitalized 'JACK' is to be construed as focussed. The other reading (the **constituent** reading) is paraphrasable by (1d).¹

- (1) a. 1. A: Did Jill kowtow?
 2. B: Jill?
 3. B: Who?
 4. B: Kowtow?
 5. B: Did what?
- b. 1. A: Is Jack in town?
 2. B: Jack?
- c. **clausal** reading: Are you asking whether JACK is in town?
- d. **constituent** reading: Who is the person named Jack you were referring to?

¹ This reading is only one of a number of understandings which could concern themselves also with clarifying the phonology and even perhaps also the syntax of a given constituent's utterance. I will ignore these other understandings in the sequel, though their existence merely strengthens a general point I will be making, namely the need to preserve a highly structured and hybrid representation of a given utterance event in the context. For a more general account, which does provide an analysis of such non-semantic readings see Cooper and Ginzburg, in preparation. That paper also relates utterance processing to issues in the representation of the attitudes.

As illustrated in (2) the constituent/clausal ambiguity can, in principle, arise equally with any syntactic type of constituent, as in the case of a verbal constituent.²

- (2) a. A: Did Jack kowtow at the party?
 B: Kowtow?
- b. **clausal** reading: Are you asking if Jack KOWTOWED?
- c. **constituent** reading: what did you mean when you said ‘kowtow’?

CE, on both clausal and constituent readings, does not respect sub-jacency or similar constraints on extraction, as illustrated in the wh-island ‘violating’ (3a). Both readings of CE do involve parallelism with the antecedent. The constituent reading seems to actually require phonological identity. With clausal readings, however, things are more subtle. On the other hand, (3b-d) show that partial syntactic parallelism does obtain: an XP used to clarify an antecedent subutterance u_1 must match u_1 categorially, though there is no requirement of *phonological* identity:³

- (3) a. A: Mary told me who Bill kowtowed to at Jill’s party.
 B: Bill?/kowtowed?
- b. A: I phoned him.
 B: him?/#he?
- c. A: Did he adore the book.
 B: adore?/#adored?

² There are exceptions, nonetheless. For instance, not surprisingly expletive constituents cannot be so clarified, as shown by (i) and (ii):

- (i) A: Did she leave? B: #Did?
 (ii) A: It’s raining. B: #It?

As Yehuda Falk has pointed out to me, there are also non-expletives that seem to resist such clarification:

- (iii) A: Will she leave? B: #Will?

A precise characterization of the class of non-clarifiable constituents I leave to future research.

³ David Tugwell suggested to me the distinction between clausal and constituent readings on this score.

- d. A: We're leaving?
 B: You?

Note also that CE is not local—its antecedent need not be the most recent utterance, as required by any approach to ellipsis resolution that relies in some way on adjacency or on a buffer containing the syntactic structure of the ‘previous utterance’ (see e.g. Sag and Hankamer, 1984; Kehler, 1993):

- (4) A: I trust John can write a thoughtful preface.
 B: John?
 A: John Crabbe.
 B: mmh. Thoughtful?
 A: Not too rash.

CE constitutes a highly interesting resolution process: it is demonstrably not one amenable to a syntactically-based account (in the sense that one could derive the required readings off some reconstructed form) and yet it clearly displays significant parallelism effects. Thus, CE poses serious problems for reconstruction-based approaches to bare ellipsis (e.g. Reinhart, 1991; Lappin and Gregory, 1997). For a start, such approaches would find the partial nature of the syntactic parallelism problematic. More seriously perhaps are the semantic problems: the required readings for CE cannot be derived. Reinhart’s approach couched in a Government Binding framework is based on LF movement of the XP construed as a generalized quantifier which predicates of a predicate formed by the λ -abstracting over the antecedent clause. Such an approach cannot generate clausal readings without assuming that illocutionary force is syntactically represented in the antecedent, an obviously problematic assumption. For constituent readings of CE the situation is even worse—there does not seem to be any obvious way for these accounts to generate readings remotely approximating the desired content. Lappin and Gregory’s HPSG approach involves copying the head daughter of the VP heading the clause in the previous conjunct and constructing an assignment of the elements of the fragment site to the copied verb’s SUBCAT list. Generating a clausal reading would involve minimally assuming illocutionary information is represented somehow in the verb’s semantics. As with Reinhart’s approach, there seems no way to get at constituent readings. A system based on Higher Order Unification (HOU) (see e.g. Dalrymple, Pereira and Shieber, 1991; Pulman, 1997) could do better than the reconstruction-based

approaches: assuming the existence of theories of context and parallelism that would set up the requisite equations, the requisite clausal clarification reading could be generated using HOU. However, there is no obvious way to extend such a system to provide constituent readings.

In this paper I will offer a proposal for a syntactic and semantic analysis of CE which combines KOS (see e.g. Ginzburg, 1996; 1998; forthcoming; Cooper, Larsson, Poesio, Traum and Matheson, 1999) and Head Driven Phrase Structure Grammar (HPSG) (see e.g. Pollard and Sag, 1994; Ginzburg and Sag, 2000). KOS⁴ is a framework for describing dialogue interaction based on combining insights from dialogue games approaches with a situation-theoretic semantic framework. The framework enables one to provide a uniform view of contextual change due to either illocutionary or utterance acts. In (Ginzburg, 1999) it was suggested that an adequate account of certain elliptical phenomena in dialogue motivates the need for postulating meanings which encode presuppositions concerning the structure of previously occurring utterances. The analysis of CE I will propose involves a generalization of this idea—replacing the purely semantic *contents* situation semantics has exploited hitherto with invariants that characterize an utterance semantically and syntactically. Technically, this will be implemented by breaking up contents into pairs of abstracts over contents carrying structural-restrictions (‘meaning’) and assignments to these abstracts (‘context’). This view of context is inspired by recent work on information states using type theory (Cooper, 1998). My claim will be that this innovation provides KOS with the means of developing a general theory of anaphoric and ellipsis processing for dialogue, though my focus here will be on nominal anaphora.

The setting for which approaches such as DRT or DPL were designed is monologue or text. Indeed, these as most formal semantic models, have hitherto abstracted away from issues pertaining to interaction such as the fact that in conversation one participant’s utterances need not be accepted or indeed comprehended by the other participants. The consequence of this has been that many actually occurring *dialogue* contributions cannot be analysed, in particular those whose primary function is to indicate comprehension or the need for clarification. However, even if one limits attention to explicating anaphoric possibilities, dialogue poses challenges of its own. I point out here some such problems, none of which besets *all* current approaches, but conversely

⁴ Kos is the name of an island, not an acronym; ‘k’ pertains to konversation and ‘s’ to semantics.

it is probably correct that no well-established framework can deal with most of these problems:

The first phenomenon, recently discussed under the rubric of cross-speaker anaphora (see e.g. Dekker, 1997), concerns the fact that nominal anaphoric use does not require acceptance by B of A's assertion:

- (5) A: A priest was looking for you.
 B: He's not a priest just an actor and I doubt he wanted to see me.

This phenomenon is particularly difficult for approaches in which anaphora is resolved with reference to a description built out of previous text (e.g. E-type anaphora on certain construals, and also for DRT and certain versions of DPL).

In fact, anaphora can even occur when one DP has not fully understood his interlocuter. In (6) B need not be able to resolve A's reference to Jill, but can use the utterance A has made to describe her:

- (6) A: Did Jill call?
 B: Is she the new computer officer?

Analyzing such cases requires a notion of partial understanding of an utterance, which is as yet absent from the afore-mentioned frameworks.

Most dynamic frameworks develop notions of pronominal accessibility which if 'turned on' intersententially cannot be subsequently 'turned off'—Asher's SDRT (Asher, 1993) is a notable exception in this regard. However, it is a robust fact, well noted in the AI literature on anaphora resolution (see e.g. Grosz and Sidner, 1986) that changing the topic of conversation drastically changes anaphoric possibilities. Thus, in (7), line 5 'he' cannot felicitously refer to Jake, despite the fact that the equivalent utterance using a directly referential expression is perfectly coherent:

- (7) 1. A: Jake hit Bill.
 2. B: No, he patted him on the back.
 3. A: Ah. Is Bill going to the party tomorrow?
 4. B: No.
 5. A: Is #he/Jake?

A systematic underdetermination of anaphoric possibilities for approaches where anaphora is triggered by NP uses in a text (or monologue) (e.g. DRT or DPL) is that in most cases in dialogue an alternative resolution of anaphora to visual/acoustic entities is possible:

- (8) [Context: a shot is heard, followed by a woman's scream:]
 A: Oh boy, she sounds scared.

In the paper I will suggest that an account of nominal anaphora adequate for dialogue and which can, in particular, offer a more or less unified account to this set of problems, emerges by combining (a) an account of how Dialogue Participants (DPs) interact over the content of utterances with (b) a situation-based view of definite reference (see e.g. (Barwise and Perry, 1983; Cooper, 1996; Poesio, 1993; Milward, 1995)). For reasons of space I will restrict attention here to anaphora to non-quantified antecedents. I start by providing some relevant background about KOS. I then move to consider how the view of utterance processing hitherto developed in KOS can be exploited to provide an analysis of CE. With the refinement in hand, I discuss how a treatment of nominal anaphora can be developed.

2. KOS: BACKGROUND AND TOOLS

2.1. *The Structure of the DGB*

KOS starts out from the assumption that conversational rules involve updates by each CP of her own *dialogue-gameboard* (DGB), a quasi-public informational repository (cf. Hamblin's *individual commitment slate*, (Hamblin, 1970)). The following view of DGB structure is assumed:

The DGB is structured by at least the following attributes:

- **FACTS**: a set of facts, closed (cf. Asher 1993) under meets and joins;
- **QUD**('questions under discussion') : a set consisting of the currently discussable questions, partially ordered by \prec ('takes conversational precedence').
- **LATEST-MOVE**: the content of *latest illocutionary move* made / understood—'A asserted that p', 'A asked q' etc.⁵

⁵ A more complex view of this attribute emerges later.

2.2. KOS: Basic Notions

DEFINITION 1. *Given a question q , an utterance u is q -specific iff $\text{content}(u)$ is either ABOUT q or INFLUENCES q .⁶*

DEFINITION 2. *If $L-M = \text{'A ASSERTS } p\text{'}$, an utterance u is an adjacency pair for $L-M$ iff $\text{content}(u)$ is p ?-specific or $\text{content}(u)$ is 'B accepts p '.*

DEFINITION 3. *If $L-M = \text{'A ASKS } q\text{'}$, an utterance u is an adjacency pair for $L-M$ iff $\text{content}(u)$ is q -specific.*

2.3. TOPICALITY

In (Ginzburg, 1997) I argued for the need to recognize a (TOPICAL v. STORED) dichotomy between two types of 'presupposed informational items': the former enter into FACTS via a 'short-term', defeasible repository structured by the elements of QUD. The latter are facts that either (after potentially being discussed) have been stored long-term or arise as side effects to issues that were never explicitly under discussion. This proposed dichotomy is inspired in part by work on fact and propositional anaphora in texts by (Webber, 1991; Asher, 1993) and enables one to propose a purely semantic, dialogical version of the Right Frontier Constraint (RFC) proposed for texts, based on an analogy that relates the text-derived notion of *open constituent* ('unexhausted topic') with the dialogue-derived notion of *question currently under discussion*.

Formally, the distinction is captured by positing two distinct repositories within FACTS: STORED is modelled classically as a set of facts closed under meets and joins. TOPICAL is treated as a set of pairs of $a = \langle \text{question}_0, \text{fact}_0 \rangle$, where question_0 (a's *address*) is an element of QUD, fact_0 is ABOUT q_0 . TOPICAL is updated using *priority union* (Carpenter, 1993), a defeasible update operation in which later accepted material takes precedence, hence allowing for an account of hasty

⁶ 'ABOUT' is a notion of partial answerhood empirically and formally characterized, together with the agent relative notion of exhaustiveness 'RESOLVES', in (Ginzburg, 1995). 'INFLUENCES' (or its converse: DEPENDS) is a sort of entailment relation between questions. It can be explicated in terms of the aboutness and resolvedness relations: q_2 INFLUENCES q_1 iff any proposition p such that p Resolves q_2 , also satisfies p About q_1 . See (Ginzburg, 1996; Ginzburg, 2001) for discussion.

accommodation. As far as querying and assertion: in this revised setup updating QUD has the additional consequence of introducing a new ADDRESS in TOPICAL about which facts can be provided, together initially with the trivial fact \top . In addition, when a new question gets introduced, the addresses for questions that are no longer under discussion are downdated from TOPICAL. This latter assumption represents an initial version of the RFC, which is generalized in a subsequent section:

- (9) **It is precisely the facts in FACTS | TOPICAL to whom access by ellipsis and pronominal anaphora is possible.**

2.4. *Ellipsis and Structural Presuppositions*

(Ginzburg, 1999) proposed an account of short answer resolution in dialogue that is semantically-based, but which also encodes as presuppositions syntactic parallelism requirements. (Ginzburg and Sag, 2000) offer an HPSG reformulation of that proposal within a more general framework which attempts to provide an exhaustive characterization of the declarative and interrogative phrasal types of English. I summarize this proposal, which is restricted for the moment to nominal fragments:⁷ as an initial step, Ginzburg and Sag posit two new attributes within the CONTEXT (CTXT) feature structure of HPSG: Maximal Question Under Discussion (MAX-QUD), whose value is of sort *question*;⁸ and Salient Utterance (SAL-UTT), whose value is a set of elements of type *sign*. The feature SAL-UTT represents a distinguished constituent of the utterance whose content is the current value of MAX-QUD. In information structure terms, it can be thought of as specifying a potential parallel element. Since it is a *sign*, it enables one to encode syntactic and phonological parallelism. Specifically, SAL-UTT is computed as the (sub)utterance associated with the role bearing widest scope within MAX-QUD:

⁷ An implementation of this system which covers short answers and sluicing is described in (Ginzburg et al., 2001).

⁸ In this framework, questions are represented as semantic objects comprising a set of PARAM(ETER)S—that is, restricted indices—and a proposition. This is the feature structure counterpart of a propositional abstract, which Ginzburg and Sag argue in great detail is what questions are.

- For *Wh*-questions, SAL-UTT is the *wh*-phrase associated with the PARAMS set of the question.⁹
- If MAX-QUD is a question with an *empty* PARAMS set, the context is underspecified for SAL-UTT. Its possible values are either the empty set or the utterance associated with the widest scoping quantifier in MAX-QUD. This will be invoked to resolve sluicing.

In Ginzburg and Sag’s account information about phrases is specified by cross-classifying them in a multi-dimensional type hierarchy. Phrases are classified not only in terms of their phrase structure schema or X-bar type, but also with respect to a further informational dimension of CLAUSALITY. Clauses are divided into *inter alia* declarative clauses (*decl-cl*), which denote propositions, and interrogative clauses (*inter-cl*) denoting questions. Each maximal phrasal type inherits from both these dimensions. This classification allows one to specify systematic correlations between clausal construction types and types of semantic content. To account for elliptical constructions such as short answers, sluicing, and CE, Ginzburg and Sag posit a phrasal type *headed-fragment-phrase* (*hd-frag-ph*)—a subtype of *hd-only-ph*—governed by the constraint in (10). The various fragments analyzed here will be subtypes of *hd-frag-ph* or else will contain such a phrase as a head daughter.¹⁰

(10) *hd-frag-ph*:

$$\left[\begin{array}{c} \text{HEAD } v \\ \text{CTXT|SAL-UTT} \end{array} \left[\begin{array}{c} \text{CAT } \boxed{1} \\ \text{CONT|INDEX } \boxed{2} \end{array} \right] \right] \rightarrow \mathbf{H} \left[\begin{array}{c} \text{CAT } \boxed{1} \left[\text{HEAD } \textit{nominal} \right] \\ \text{CONT|INDEX } \boxed{2} \end{array} \right]$$

This constraint has two significant effects. First, it ensures that the category of the head daughter—restricted to be *n(oun)* or *p(reposition)*, the two subtypes of *nominal*—is identical to that specified by the contextually provided SAL-UTT. The mother is specified to be of category *v*, which will allow such phrases to serve as stand-alone clauses and also to function as the complement of a verb that selects for clauses, but not for NPs. Second, the constraint coindexes the head daughter with

⁹ More generally, the utterance associated with the PARAMS set when this is non-empty. This can arise when the antecedent is not an interrogative clause, for example in the CE examples discussed below. In such cases, SAL-UTT will be the utterance of the constituent to be clarified.

¹⁰ The constraint here relates the mother to its (sole) daughter, denoted with a large bold faced **H**.

the SAL-UTT. This will have the effect of ‘unifying in’ the content of the former into a contextually provided content.

The first subtype of *hd-frag-ph* I consider here is one used to analyze short answers and (clausal readings of) CE. (11) is the constraint characterizing *declarative-fragment-clause* (*decl-frag-cl*)—also a subtype of *decl-cl*:

(11) *decl-frag-cl*:

$$\begin{array}{c}
 \left[\begin{array}{c} \text{STORE} \\ \text{CONT} \\ \text{MAX-QUD} \end{array} \begin{array}{c} \boxed{\Sigma_1} \\ \left[\begin{array}{c} \text{SIT} \quad \boxed{2} \\ \text{SOA} \left[\begin{array}{c} \text{QUANTS} \quad \text{order}(\boxed{\Sigma_3}) \oplus \boxed{A} \\ \text{NUCL} \quad \boxed{5} \end{array} \right] \end{array} \right] \\ \left[\begin{array}{c} \text{question} \\ \text{PARAMS} \quad \text{neset} \\ \text{PROPOSITION} \\ \text{SIT} \quad \boxed{2} \\ \text{PROP} \left[\begin{array}{c} \text{SOA} \left[\begin{array}{c} \text{QUANTS} \quad \boxed{A} \\ \text{NUCL} \quad \boxed{5} \end{array} \right] \end{array} \right] \end{array} \right] \end{array} \right] \\
 \rightarrow \mathbf{H} \left[\text{STORE} \quad \boxed{\Sigma_3} \cup \boxed{\Sigma_1} \text{set}(\text{param}) \right]
 \end{array}$$

The content of this phrasal type is a proposition. The information in this constraint derives primarily from the context: whereas in most headed clauses the content is entirely (or primarily) derived from the head daughter, here it is constructed for the most part from the contextually salient question. This provides the concerned situation and the nucleus, whereas if the fragment is (or contains) a quantifier, that quantifier must outscope any quantifiers already present in the contextually salient question. Finally, the constraint also ensures that if the head daughter contributes a parameter to the store (due to the presence of a *wh*-phrase), that parameter remains stored. A simple example follows:

(12) A: Who left?
B: Jo

Here A’s (sub)utterance of *who* is the SAL-UTT:

$$(13) \left[\begin{array}{cc} \text{CAT} & \text{NP} \\ \text{CONT} & \left[\begin{array}{c} \text{param} \\ \text{INDEX} \quad \boxed{1} \\ \text{REST} \quad \{\} \end{array} \right] \\ \text{STORE} & \left\{ \left[\begin{array}{c} \text{param} \\ \text{INDEX} \quad \boxed{1} \\ \text{REST} \quad \{ \text{person}(\boxed{1}) \} \end{array} \right] \right\} \end{array} \right]$$

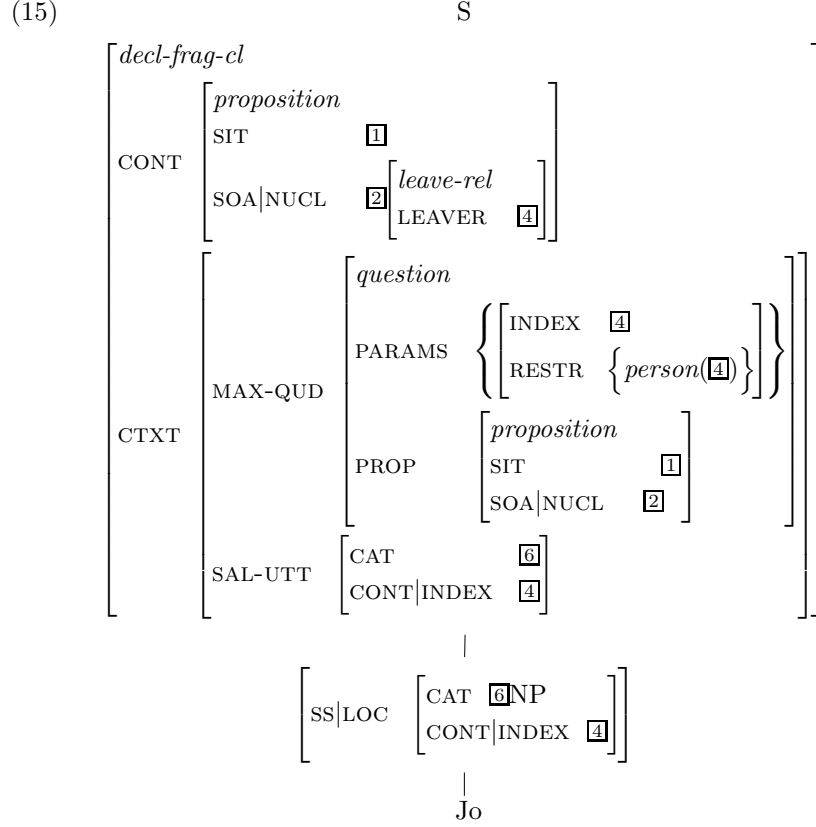
And the full utterance makes the following question MAX-QUD:

$$(14) \left[\begin{array}{cc} \text{question} \\ \text{PARAMS} & \left\{ \left[\begin{array}{c} \text{INDEX} \quad \boxed{1} \\ \text{RESTR} \quad \{ \text{person}(\boxed{1}) \} \end{array} \right] \right\} \\ \text{PROP} & \left[\begin{array}{c} \text{proposition} \\ \text{SIT} \quad \text{s} \\ \text{SOA} \quad \left[\begin{array}{c} \text{QUANTS} \quad \langle \rangle \\ \text{NUCL} \quad \left[\begin{array}{c} \text{leave-rel} \\ \text{LEAVER} \quad \boxed{1} \end{array} \right] \end{array} \right] \end{array} \right] \end{array} \right]$$

B's utterance thus gets the analysis in (15).

3. INTERACTING OVER UTTERANCES: MOTIVATION FOR STRUCTURED REPRESENTATION OF UTTERANCES

(Ginzburg, 1998) develops a view of utterance understanding and updates which can be summarized as follows: for an addressee B, as soon as she forms the belief that an utterance u has taken place whose meaning she recognizes to be μ , she needs to consider the question **content**($\mathbf{u}, \mathbf{A}, \mu(\mathbf{u})$)? ('what did A intend to convey with u whose meaning is μ ?'): this is a complex question obtained by conjoining the (conventional) content question $\text{CONTENT}(u, \mu)?$ and the goals question $\text{GOALS}(u, A)?$. Roughly: $\text{CONTENT}(u, \mu)?$ is the question individuated by the utterance u and μ , the abstract corresponding to the (Kaplan/situation semantics view of) sentential meaning used in u ,



in other words the n-ary SOA abstract where the variables abstracted over correspond to the contextual parameters. Thus, $\text{CONTENT}(u, \mu)?$ can be paraphrased as ‘what values do the contextual parameters of μ get in u ’; $\text{GOALS}(u, A)?$ is the question ‘what goals did A have in making u ’. It is only if B believes she knows answers sufficiently detailed for her current purposes to **content**($\mathbf{u}, \mathbf{A}, \mu(\mathbf{u})$)?, i.e. to both $\text{CONTENT}(u, \mu)?$ and to $\text{GOALS}(u, A)?$, that she can proceed to update her DGB, updating L-M with the content of u and acting in accordance with the illocutionary act that this specifies; otherwise a clarification stage must ensue.¹¹ This clarification stage can be charac-

¹¹ For simplicity in the current paper I ignore the role of $\text{GOALS}(u, a)?$ entirely.

terized with significant precision in KOS: in those cases where B cannot resolve $\text{content}(\mathbf{u}, \mathbf{A}, \mu(\mathbf{u}))?$, she makes $\text{content}(\mathbf{u}, \mathbf{A}, \mu(\mathbf{u}))?$ QUD-maximal. This has *inter alia* the consequence that B is constrained now to provide an utterance which is $\text{content}(\mathbf{u}, \mathbf{A}, \mu(\mathbf{u}))?$ -specific. This includes the possibility of posing any question that INFLUENCES $\text{content}(\mathbf{u}, \mathbf{A}, \mu(\mathbf{u}))?$.

The account as formulated in (Ginzburg, 1998) was based on a standard situation semantic view of the relationship between meaning and content: contents are SOAs (specifying illocutionary information, speaker and descriptive content) and meanings are n-ary abstracts over contents, where the variables abstracted over correspond to the contextual parameters. However, this standard view does not jibe well with CE: the central representational desideratum brought home by the phenomenon of CE is that the semantic representation of an utterance must be sufficiently structured so as to allow the content of each semantically potent subutterance to be maintained separately, as well as representing the full content that arises by composing the contents of the subutterances. Thus, one intrinsic problem for the view of meaning situation semantics inherited from Kaplan is the *a-prioristic* decision as to which constituents of content are to be adjudged context-dependent, and therefore liable to be abstracted away as contextual parameters. To deal with CE we need an altogether more equalitarian view—one which makes at least all semantically potent constituents contribute parameters which get instantiated with the corresponding subutterances. But more is required apart from this hyper-structurification of meanings.

On a standard syntax/semantics interface, the syntax has no role beyond bringing about the composition of the content. With this task achieved, the syntactic information might as well decay instantly. However, the parallelism data of CE reveal a different story, one that treats the syntax less cavalierly: just as we need a representation that preserves the content of each semantically potent subutterance, we need also to preserve in some way *minimally* the local syntactic features of each such subutterance. The representation needed, then, should not only be highly structured on the semantic front, it also needs to be hybrid in nature—encompassing semantic *and* syntactic information.

We should, consequently, no longer think of the contextual impact of utterances as essentially described by their fully composed semantic content, but rather as one to be described in terms of an altogether more structured and hybrid representational entity, one that reifies the history of the construction of the utterance. Of course, this representation must be such as to allow a standard semantic content

to be ‘read’ off it somehow, but not at the price of losing all other information that has emerged during the utterance event. Incidentally, this view has suggestive independent support from work on memory for conversations—see (Fletcher, 1994) for a review of psycholinguistic evidence for three distinct types of memory traces, the surface form, the propositional text base, and the situational model.

There are a number of ways to go about modelling the required representational entity, which I shall dub—for want of a better term—a Structured Utterance Invariant (SUIT). Here I follow the approach developed within a type theoretical framework by (Cooper, 1998).¹² A SUIT will consist of of a pair of an n-ary abstract (the UTT(ERANCE)-SKEL(ETON)—an object reifying the history of the construction of the utterance meaning) and a contextual assignment (CNTXT-ASS), whose range comprises tokens corresponding to perceived (sub)utterance-events and utterance content-like objects such as referents and properties. This abstract/assignment pair is constrained by the fact that applying the abstract to the assignment must yield the full compositional content. The roles specified by the abstract are roles corresponding to each semantically potent constituent and carry appropriacy restrictions. These appropriacy restrictions are the locus for encoding, *inter alia*, syntactic conditions which utterance tokens associated with such roles must meet. I assume that the contents which update QUD and TOPICAL preserve this partition into utterance skeleton and context-assignment. A simple example of a SUIT is given in (16).

To summarize: in this section I have proposed a revision to the standard situation theoretic notions of meaning and content, motivated primarily by the phenomenon of CE. The upshot of this is the positing of SUITs—structured utterance invariants, where both type-like information concerning the structure of the utterance (the utterance-skeleton), as well as information about sub-utterance and referent tokens (the contextual assignment) is represented. Of course the goals underlying this move go beyond providing a treatment of CE. CE, by forcing us to preserve in the context a highly structured and hybrid representation, opens up the prospects of developing KOS into a general theory of anaphora and ellipsis resolution for dialogue. This by defining abstraction and substitution operations over SUIT’s within the general contextual framework provided by KOS. In the current paper I will illustrate some of the possibilities by sketching first an analysis of

¹² (Ginzburg and Cooper, 2001) show how a close variant on an HPSG sign can fill the function of an utterance skeleton.

(16) a. Bill relies on Jill.

$$\begin{array}{l}
 \text{b.} \left[\begin{array}{l} \text{UTT-SKEL} \\ \text{CNTXT-ASS} \end{array} \left[\begin{array}{l} \lambda A, s, u_{bill}, b, u_{jill}, j, u_{rely}, R \\ \langle\langle \text{Assert}, A, (s ! \langle\langle R, b, j \rangle\rangle) \rangle\rangle \\ \text{RESTRICTIONS} \left\{ \begin{array}{l} \langle\langle =, b, \text{content}(u_{bill}) \rangle\rangle, \\ \langle\langle =, j, \text{content}(u_{jill}) \rangle\rangle, \\ \langle\langle \text{SPEAKER}, A \rangle\rangle, \\ \langle\langle =, \text{content}(u_{rely}), R \rangle\rangle, \\ \langle\langle =, \text{NP}[+nom], \text{cat}(u_{who}) \rangle\rangle, \\ \langle\langle =, \text{PP}[+on], \text{cat}(u_{onwhom}) \rangle\rangle, \\ \langle\langle =, \text{V}[+pst], \text{cat}(u_{rely}) \rangle\rangle \end{array} \right\} \\ (u_{bill} : u1, b : BILL, u_{rely} : u2, \\ A : A0, s_0 : s0, u_{jill} : u3, j : JILL, r : RELY) \end{array} \right] \right]
 \end{array}$$

CE and then proceeding to consider briefly the problem of nominal anaphora in dialogue.

4. CLARIFICATION ELLIPSIS: AN ACCOUNT

In this section, I sketch the analysis I propose for CE. The analysis has two essential components, contextual and grammatical: the former concerns the contextual update which underpins a request for clarification. This aspect I can, for reasons of space, only sketch briefly and informally; a detailed account can be found in (Ginzburg and Cooper, 2001; Ginzburg, 2001). The basic idea, common to both clausal and constituent readings of CE, is that upon failure by a DP to resolve the utterance skeleton associated with a perceived utterance, the utterance skeleton is coerced, using a given set of coercion operations, to a new utterance skeleton. This latter is one appropriate for the (partially specified) contextual information available to the DP and its content is a question. The second component concerns grammatical analysis, where I follow (and in the case of constituent readings extend) the analysis of (Ginzburg and Sag, 2000).

4.1. Clausal Readings

I start by discussing clausal readings. If B chooses the clarification option, she updates QUD with **content(u,A, $\mu(u)$)?** and above that with a more specific question *clar-q₁*, which she obtains from **content(u,A, $\mu(u)$)?** by partially instantiating $\mu(u)$ with the values for contextual variables she does have. The clausal reading for a CE ellipse can now arise, using the type *decl-frag-cl* discussed above for short answers. To illustrate, the analysis provided for (17a) involves B introducing as QUD-maximal the question (paraphrased) in (16c) and the SAL-UTT derives from A's utterance of the NP *Jo*. The literal reprise is thus analyzed as illustrated in (18).¹³

- (17) a. A: Did Jo leave?
 B: Jo?
- b. Are you asking if JO left?
- c. Who_i are you asking if i left.

4.2. Constituent Readings

A similar account can be developed for constituent readings, with one important difference: by means of an operation on the utterance skeleton, QUD gets updated with a question which pertains to the content of a sub-utterance. The fragment is then analyzed as a kind of *hd-frag-ph*. The difference from the clausal case is that in constituent readings **the content of the fragment does not (directly) contribute its conventional content to the clausal content**. The function of the fragment is, rather, to serve as an anaphoric element to the to-be-clarified sub-utterance. This anaphora is facilitated by phonological identity requirement between the fragment and the SAL-UTT. The content derives entirely from MAX-QUD. These two facets of constituent readings are idiosyncratic to this construction and thus needs to be stipulated. In (19) I posit a new phrasal type *constit-repr-int-cl*, a subtype of *head-frag-ph* and of *inter-cl*.

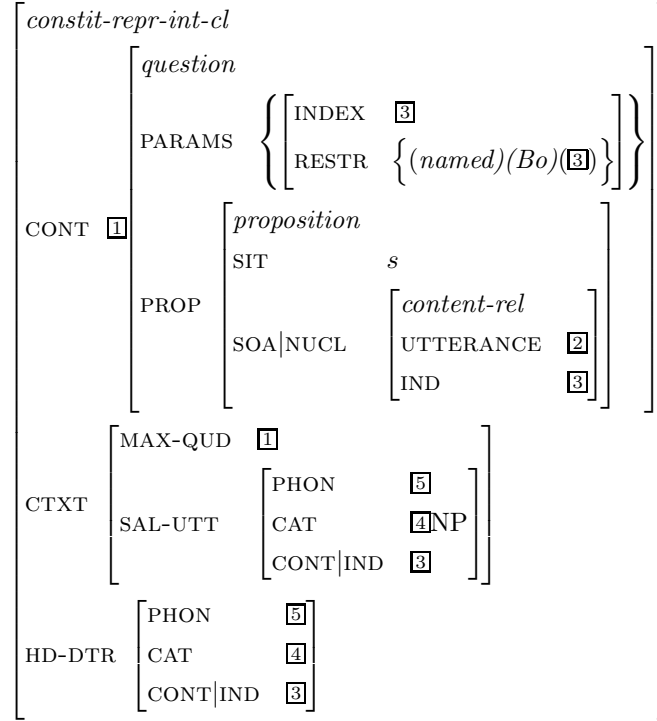
¹³ The phrasal type *dir-is-int-cl* which constitutes the type of the mother node in (18) is motivated in (Ginzburg and Sag, 2000) to deal with diverse kinds of interrogatives including *wh-in situ* clauses such as *Bill left when?* and intonation questions such as *Bill left yesterday?*

S


$$\begin{bmatrix} \text{CONT} & \boxed{1} \\ \text{CTXT} & \begin{bmatrix} \text{MAX-QUD} & \boxed{1} \\ \text{SAL-UTT} | \text{PHON} & \boxed{2} \end{bmatrix} \end{bmatrix} \rightarrow \mathbf{H}[\text{PHON} \ \boxed{2}]$$

A simple example follows:

- (20) a. A: Did Bo kowtow? B: Bo?
 b. Who is the content of utterance u_0 (the referent named *Bo* referred to in the utterance of ‘Bo’)?



5. NOMINAL ANAPHORA/ELLIPSIS AND DEFINITE REFERENCE

I now provide one further application of the revised framework: I indicate how a theory of nominal anaphoric processing can be developed by combining the perspective on utterance interaction developed above and a situation-based view of definite reference.

5.1. *Deictic definites*

(21(2)) illustrates a key phenomenon for use of definites, one we have already seen above in (5) for anaphora, in dialogue: the definite is felicitous despite the fact that B does not accept A’s assertion:

- (21) A(1): John walked in.
 B(2): The door was open?

The classical situation semantics treatment of definites (see e.g. (Barwise and Perry, 1983; Gawron and Peters, 1990; Cooper, 1996; Poesio, 1993; Milward, 1995)) involves positing a *resource situation*, a contextual parameter which can but need not be distinct from the described situation. The resource situation underwrites existence and uniqueness. A possible situation semantics account of (21(2)) in line with KOSIS this: in (21(1)) A asserts the proposition $(s_0 ! \langle \langle \text{ENTERED}, j \rangle \rangle)$, where A is making reference to some situation s_0 . B having understood (21(1)) does not accept the assertion, but rather makes $(s_0 ? \langle \langle \text{ENTERED}, j \rangle \rangle)$ QUD-maximal. B's query is licensed since he poses a question which INFLUENCES $(s_0 ? \langle \langle \text{ENTERED}, j \rangle \rangle)$, in particular this means that the described situation of his question is s_0 . B believes that it is commonly presupposed of s_0 , regardless of whether it supports John's walking in, that it has a unique door and this is why the definite reference is possible.

Although certain key details remain to be worked out, such an account provides a relatively straightforward account of definite reference as a dynamic process, which transfers readily to a dialogue setting: A makes an utterance whose understanding involves reference to a situation; if B can resolve that reference, certain objects whose existence within that situation can be inferred become available for reference with definite descriptions.

What has been missing hitherto from most situation semantics accounts is an account of:¹⁴

- The relation between resource situations and described situations: which situations are available as resource situations when?
- How long is a given resource situation available for resolution and what controls its availability?
- Where do resource situations reside in such a way as to be used for resolution?

These issues become particularly acute when one considers pronominal anaphora.

¹⁴ (Poesio, 1993; Milward, 1995) are notable exceptions which offer highly explicit accounts of certain aspects of all three issues.

5.2. *Pronominal Anaphora*

In common with a variety of work (including (Hintikka and Kulas, 1985), (Milward, 1995)), I will treat third person pronouns as definite descriptions: singular ones involve a uniqueness presupposition, whereas plural ones a maximality presupposition. To what extent is such an assimilation viable?¹⁵

The most obvious difference between *the N*-like definite descriptions and anaphora is that the latter are not as easily inferable as the former:

(22) a. A(1): John walked in.

B(2): #It was open?

B(2'): He managed to get in?

(23) a. A: John walked straight past the door.

B: It was open?

This contrast is, arguably, a matter of degree: for a start, deixis makes anaphors felicitous without an overt antecedent:

(24) a. [Context: a shot is heard, followed by a woman's scream:] A:
Oh boy, she sounds scared.

b. A: There is something I have to tell you.

B: What?

A: I was pregnant and gave birth. She died a day after the birth.

c. A couple sat down on a bench. He was annoyed, she wasn't.
(From (Hintikka and Kulas, 1985))

Such examples suggest it is a mistake to incorporate an explicit antecedent condition on nominal anaphora: optimally, what is desirable, as noted by (Poesio, 1993), is a unified deictic/anaphoric meaning

¹⁵ See (Garrod and Sanford, 1994) for review of psycholinguistic evidence demonstrating differences in processing pronouns and *the N*-like definite descriptions. However, all evidence cited there concerns data from processing *text*. Whether such differences extend to the processing of deictic pronouns apparently remains to be extensively investigated.

whose sole difference arises, in some sense, from the contextual resources used. But here there is an apparent problem: (singular) anaphora is of course possible even when there is more than one possible similar gendered individual in the described situation:

(25) A: John likes Bill. He thinks he's a nice kid.

Given the perspective of section 3 there is a well-motivated solution available: we assume that the utterance situations of NPs constitute available resource situations for definites. So the dynamic story about reference presented in section 5.1 can now be generalized: referents come in courtesy not just of the described situation, but also courtesy of utterance situations, which enter in the DGB subsequent to utterance update. More generally, we hypothesize the following generalization to (9):

(26) It is the situations currently represented in the context assignments of QUD/TOPICAL that constitute possible resource situations for definites.

An utterance situation for an NP will fix:

- A referent (or witness/witness set for quantificational NPs)
- Agreement information
- Categorical information (recall parallelism constraints exhibited by CE in section 4.)

Indeed in most languages gender agreement, to a greater or lesser extent, depends on grammatical information which does not inhere in the referent independently of a given utterance. To take one example: Hebrew, which lacks a neuter gender and correspondingly has no neuter pronouns, has two words which correspond to the English *car*, one is masculine, the other feminine. Subsequent pronominal reference must agree with the gender of the antecedent:

(27) ledani yesh óto yafe. hu kana otó/#ota belondon.
 Dani has car-masc nice-masc. he bought him/#her in-London.
 Dani has a nice car. He bought it in London.

(28) ledani yesh mexonit yafa. hu kana #otó/ota belondon.
 Dani has car-fem nice-fem he bought #him/her in-London.
 Dani has a nice car. He bought it in London.

Basing anaphoric resolution on utterance situations allows both agreement and referent identity information to be simultaneously in the context for as long as the anaphoric potential exists. Agreement constitutes a problem for dynamic systems where the only information maintained concerns referents, as e.g. in DPL and in standard DRT. Two additional semantic advantages for basing anaphoric dynamics on an analysis as definites whose resource situations (can be) utterance situations are these. First, we can explain how anaphora can occur in cases where understanding is incomplete: in (6) repeated here as (29) B need not be able to resolve A's reference to Jill, but can use A's utterance A made to describe her:

(29) A: Did Jill call?/B: Is she the new secretary?

A second and related feature concerns a fundamental requirement for anaphora in a dialogue setting, put forward in (Kamp, 1990) (see also (Paul, 1996; Dekker, 1997)), that where correct understanding has ensued the participants presuppose that they are *talking about the same thing*. Within the current proposal this can be accounted for as follows: B's understanding an utterance u is based on her considering whether she knows a suitably detailed answer to **content(u, A, $\mu(u)$)**? In particular, such a fact will provide values for the (sub)utterances of u . Understanding an anaphoric utterance requires of the DP B that she believes she resolved the requisite resource situation, typically an utterance situation, identically with A. Thus, regardless of whether B can resolve the reference of that anaphoric use (as e.g. in (29)), B's grounding the utterance requires her to believe that they share the belief about which is the resource situation for that anaphor.

Finally, let us see how the account can capture the *topic change effect* for anaphora: anaphora to a given entity is possible only insofar as s/he is associated with a question currently under discussion: an NP use will result in the utterance situation being in QUD, regardless of whether it constitutes accepted information or not. There it will remain until the question it is associated with gets downdated. In case information is accepted, it remains in an address in TOPICAL, corresponding to a question still in QUD.¹⁶ This process is illustrated sketchily in (30) and (31):¹⁷

(30) a. QUD update resulting from A: Jake hit Bill.

¹⁶ For details, see (Ginzburg, 2001).

¹⁷ The notation QUD: $p_1? : \mu_1^?[u1, u2]$ means that QUD contains the question $p_1?$, represented as a meaning ($\mu_1^?$)/context-assignment($u1, u2$) pair. The

$$\text{b. } \left[\begin{array}{c} \text{UTT-SKEL} \\ \text{CNTXT-ASS} \end{array} \begin{array}{c} \mu_1^? \\ \left[\begin{array}{c} \text{RESTR} | u_1 \\ \text{RESTR} | u_2 \end{array} \right] \end{array} \left[\begin{array}{c} \lambda s, u_1, X, u_2, Z \\ \langle \langle s ? \langle \langle \text{HIT, hitt-er:X, hitee:Z} \rangle \rangle \rangle \rangle \\ \left\{ \langle \langle \text{NAMED, 'jake', X} \rangle \rangle, \langle \langle =, \text{cont}(u_1), X \rangle \rangle \right\} \\ \left\{ \langle \langle \text{AGR, 3sg} \rangle \rangle, \langle \langle \text{CAT, NP[+nom]} \rangle \rangle \right\} \\ \left\{ \langle \langle \text{NAMED, 'Bill', X} \rangle \rangle, \langle \langle =, \text{cont}(u_2), Y \rangle \rangle \right\} \\ \left\{ \langle \langle \text{AGR, 3sg} \rangle \rangle, \langle \langle \text{CAT, NP[+acc]} \rangle \rangle \right\} \end{array} \right] \\ \left[s:s_0, u_1:u_1, X:j, u_2:u_2, Z:b \right] \end{array} \right]$$

(31) ...

A: Jake hit Bill.

QUD: $p_1?$: $\mu_1^?[s_0, u_1, u_2]$

B: No, he patted him on the back.

QUD: $p_1? \prec p_2?$: $\mu_2^?[s_0, u_1, u_2]$

A: Ah. p_2 accepted, $p_2?$, $p_1?$ downdated.

TOPICAL: $\langle \text{question:} p_2?; \text{fact:} \text{soa}(p_2) \rangle$

A: Is Bill going to the party tomorrow?

QUD: $p_3?$: $\mu_3^?[s_1, u_1]$

TOPICAL: $\langle \text{question:} p_3?; \text{fact:} \top \rangle$

s_1 and u_1 are the available situations in TOPICAL at this point. s_1 is the party situation and so, without special information, there is no evidence for a unique male there. The referent of u_1 is Bill, so he is the sole possible anaphorisible entity:

B: No. Is #he/Jake? ('he' cannot felicitously refer to Jake, despite the fact that the equivalent utterance using a directly referential expression is perfectly coherent).

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assignments provided here are abbreviated in that they contain merely situations, the objects controlling pronominal resolution. Finally, the notation $\mu_1^?$ refers to the y/n-question abstract, corresponding to a propositional abstract, analogously to the y/n-question $p?$ corresponding to the proposition p , as illustrated in (30).

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